

REMARKS/ARGUMENTS

Favorable reconsideration of this application in light of the following discussion is respectfully requested.

Claims 1-12 are pending in the present application. No claims are amended by the present amendment, thus, no new matter is added.

In the outstanding Office Action, Claims 1, 3, 4, 11, 28-30, 41, 45 and 47-53 were rejected under 35 U.S.C. §103(a) as unpatentable over Raoux et al. (U.S. Pat. No. 7,004,107, herein "Raoux") in view of Shannon et al. (U.S. Pat. Pub. No. 2003/0192475, herein "Shannon") and Ohmi (U.S. Pat. No. 5,272,417); Claims 6 and 46 were rejected under 35 U.S.C. §103(a) as unpatentable over Raoux, Shannon and Ohmi in further view of Collins et al. (U.S. Pat. No. 6,252,354, herein "Collins"); and Claims 18, 19, 54 and 55 were rejected under 35 U.S.C. §103(a) as unpatentable over Raoux, Shannon and Ohmi in further view of Hillker (U.S. Pat. No. 6,631,693).

Addressing now the rejection of Claims 1, 3, 4, 11, 28-30, 41, 45 and 47-53 under 35 U.S.C. §103(a) as unpatentable over Raoux, Shannon and Ohmi, Applicants respectfully traverse this rejection.

Claim 1 recites, in part,

an impedance setting section provided in addition to the matching circuit and arranged between said one of the first and second electrodes and the matching circuit on the first interconnection, the impedance setting section being configured to select a higher harmonic of a fundamental frequency of the RF power, which is input from the plasma into the first interconnection, and to set an impedance relative to the selected higher harmonic thereby causing the higher harmonic to increase by a resonance action, the impedance setting section being capable of changing the selected higher harmonic to be treated as a resonance target; and

a controller which supplies a control signal for controlling the impedance setting section to control a characteristic of a plasma process performed in the process chamber,

wherein the impedance setting section comprises:

an impedance change unit connected to the first interconnection through a shunt and configured to select the higher harmonic as a resonance target, and  
a filter disposed on the shunt between the first interconnection and the impedance change unit and configured to cut off the fundamental frequency of the RF power.

Claim 45 recites similar features with regard to causing the higher harmonic to increase by a resonance action.

Raoux describes an impedance tuner 108 that is used for the impedance of reactor 30. However, as acknowledged on pages 4-5 of the outstanding Action, Raoux does not describe or suggest the impedance setting section as is recited in Claim 1.

Nevertheless, the outstanding Action cites Shannon as curing this deficiency of Raoux.

Shannon describes a method and apparatus for routing harmonic energy within a plasma to ground in a plasma enhanced semiconductor wafer processing reactor. Further, Shannon describes in paragraph 0007, lines 7-10 that “the placement and design of a harmonic shunt can be determined to route the harmonic energy to ground and suppress the effect of the harmonic energy upon the plasma processing.” Further, Shannon states in paragraph 0007 that “the RF feed structure is modified to produce a low impedance path to ground for the harmonic energy without using additional circuitry. ***With the reduction of harmonics in the plasma, the plasma processing uniformity is improved over the prior art***” (emphasis added). In other words, the method and apparatus of Shannon has been developed with the aim to reduce harmonics.

Applicants note that conventionally it has been generally believed that harmonics generated during a plasma process adversely affect the process. It is based on this belief that the method and apparatus of Shannon has been derived.

In contrast, the claimed invention recites “causing the higher harmonic to increase by a resonance action.” Thus, the claimed invention recites increasing a harmonic, which is completely opposite to the desired effect of Shannon.

Moreover, according to the claimed invention, the apparatus is arranged to cause a higher harmonic to increase by a resonance action so as to improve the uniformity of a plasma process and to stabilize the plasma state. This arrangement of the claimed invention has been made based on an inventive discovery of the claimed inventors which is opposite to the conventional understanding on this subject. Thus, as a result, the claimed invention would not have been obvious based on the disclosure of Shannon and this reference cannot be cited as curing the deficiencies of Raoux at least because the disclosure of Shannon teaches away from the claimed features.

The outstanding Action asserts on page 5 that although “Shannon et al do not explicitly teach that the harmonic routing circuit 324 causes the higher harmonic in the plasma to increase by resonance action, it would be obvious to configured the impedance setting unit to select a higher harmonic of a fundamental frequency of the RF Power ...thereby causing the higher harmonic to increase by a resonance action.” However, as is noted above, Shannon teaches away from such an increase and thus it would not be obvious to cause the higher harmonic to increase as is asserted by the outstanding Action.

Accordingly, Applicants respectfully submit that Shannon does not cure the deficiencies of Raoux with regard to the claimed invention. Nevertheless, the outstanding Action has cited Ohmi as curing the deficiencies of Raoux and Shannon with regard to the claimed invention.

Ohmi describes a plasma process device which includes a power supply 110, a matching circuit 108 and a band eliminating filter 401. Further, although Ohmi mentions higher harmonics in col. 13, lines 16-23, this mention relates to nothing more than an

assertion that frequencies of RFs applied at the same time should be selected to prevent higher harmonics of one of the RFs from overlapping with the frequency of another one of the RFs.

In other words, Ohmi merely describes selection of the frequencies of RFs in light of higher harmonics, which is not equivalent to "causing the higher harmonic to increase by a resonance action" as is recited in the claimed invention.

Thus, Ohmi does not cure the deficiencies of Raoux and Shannon with regard to the claimed invention.

Accordingly, Applicants respectfully submit that Claim 1 and similarly Claim 45, and claims depending therefrom, patentably distinguish over Raoux, Shannon and Ohmi considered individually or in any proper combination.

Further, the further cited Collins and Hilliker references do not cure the above noted deficiencies of Raoux, Raoux, Shannon and Ohmi.

Consequently, in light of the above discussion and in view of the present amendment the present application is believed to be in condition for allowance and an early and favorable action to that effect is respectfully requested.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,  
MAIER & NEUSTADT, P.C.

Customer Number  
**22850**

Tel: (703) 413-3000  
Fax: (703) 413 -2220  
(OSMMN 08/07)

Steven P. Weihrauch  
Attorney of Record  
Registration No. 32,829

James Love  
Registration No. 58,421